NASA Activities

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Cover

Payload Practice—The first flight crew of the Space Shuttle *Columbia,* astronauts John Young (commander, at left) and Bob Crippen (pilot), inspect the Columbia's aft flight deck station. During orbital flight, the crew will handle the payload from this position, placing it in orbit from the cargo bay.

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Letter from Washington

Dear Colleagues:

Perhaps at no time since the Apollo days has public attention been focused so strongly on the space program. Stories and photographs of the Space Shuttle have appeared on the front pages of major newspapers across the country. The Shuttle has been the subject of a Time magazine cover story and a CBS television documentary. And its crew, astronauts John Young and Robert Crippen, are becoming familiar faces to millions of American television viewers through their appearances on such shows as "Good Morning America."

This public interest in the Shuttle follows hard on the heels of the widespread media coverage of Voyager's spectacularly successful close encounter with Saturn in November. Small wonder then, that there is a new sense of enthusiasm and support across a broad spectrum of our society for the space program and its potential.

Near record crowds are touring the Visitor Information Center at the Kennedy Space Center. The Viking Fund, a private organization under the auspices of the American Astronautical Society has presented a $60,000 check to NASA to support continued operation and scientific analysis of the Viking Lander on Mars. And more than 30 space-oriented citizens' groups have sprouted over the past five years, with total membership of close to 40,000, to engage in activities ranging from lobbying to public education.

All of this, of course, is good news to us at NASA. A deep interest and abiding commitment by people of all kinds and all ages to a strong and ongoing space effort can be of immense benefit to us this year and in the years ahead. At the dawn of a new era in space transportation, we can take pride and encouragement from grass roots public support as we continue our efforts to learn more about the solar system and the universe and apply that knowledge to master our problems here on earth.

Sincerely,

A. M. Lovelace

A. M. Lovelace

Shuttle Launch in April

NASA scheduled the Flight Readiness Firing of the Space Shuttle Columbia's main engines for Feb. 19 and estimates the launch of the Columbia will be no earlier than the week of April 5.

The schedules were set following a test readiness review in preparation for the flight readiness firing. The review was completed Jan. 30.

The change of several days in the readiness firing schedule was required to accommodate a number of minor problems encountered during this first-time integration of the Shuttle with ground launch systems.

During propellant tanking tests, two areas of insulation on the external tank, one approximately 7 by 8 feet and the other about 4 by 4 feet, became debonded.

This did not affect the flight readiness firing, but the Shuttle must be rebonded before launch.

A preliminary estimate of the time required for the repair indicates that the launch date will be no earlier than the week of April 5.

Voyager 2 Enroute to Uranus

NASA has officially approved the continuation of Voyager 2 on a trajectory which would take it to Uranus in 1986 after flying past Saturn this summer. Under the approved plan, the spacecraft will encounter Uranus at a distance of 107,000 kilometers on Jan. 24, 1986, making measurements and taking pictures as it speeds past and heads for a possible encounter with Neptune.

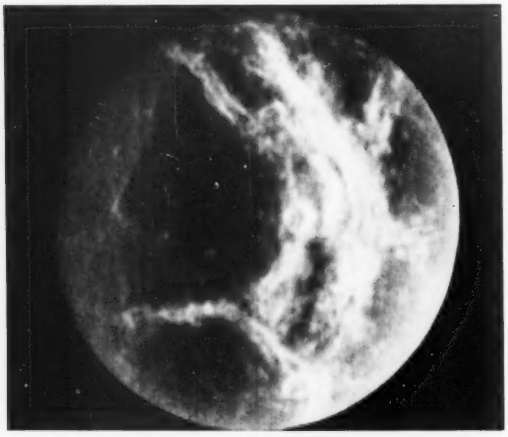
The Uranus encounter will provide the world with its first close-up look at that planet. Uranus is the seventh planet outward from the Sun, twice as far from the Sun as Saturn; it rotates on its axis at a tilt of 98 degrees. It is a grim, frozen world.

The decision to fly past Uranus is, in effect, a decision to retain the present trajectory. If agency officials had decided against a Uranus encounter, then a retargeting of the Voyager 2 would have been required.

Voyager 2, launched Aug. 20, 1977, is a sister ship to Voyager 1, which recently provided a historical close-up encounter with the ringed planet Saturn. Voyager 2 flew by Jupiter in July 1979 and will encounter Saturn Aug. 25, 1981.

Voyager 1's trajectory through the solar system was selected to optimize the scientific objectives at Jupiter, Saturn and Titan. The path of Voyager 2 was chosen to provide a course to Jupiter, Saturn and Uranus, and perhaps Neptune. This path does not provide a close-up approach to Titan or a Saturn ring occultation which were among the goals of the Voyager 1 mission. The final decision to remain on this trajectory had to await the successful outcome of Voyager 1's close encounter with Saturn and Titan in November 1980.

Voyager 1 has achieved all of the prescribed Saturn/Titan scientific objectives. The assessment of the health of the Voyager 2 spacecraft and instruments indicates that there is a reasonable probability that the five-year journey to Uranus can be endured and a scientifically productive flyby can be achieved. "On this basis, therefore, the decision has been made to retain the present Uranus trajectory for Voyager 2," said Andrew J. Stofan, Acting Associate Administrator for Space Science. He pointed out that retargeting of the spacecraft to provide another close Titan flyby could have been made as late as early 1981.



More from Saturn—With Voyager 2 targeted for Uranus, pictures and data are still coming forth from the Voyager 1 encounter with Saturn. This is Saturn's moon Dione, with large, bright streaks crossing its face. According to the Jet Propulsion Laboratory, some of the streaks may be grooves resulting from a fracturing in the satellite's surface.

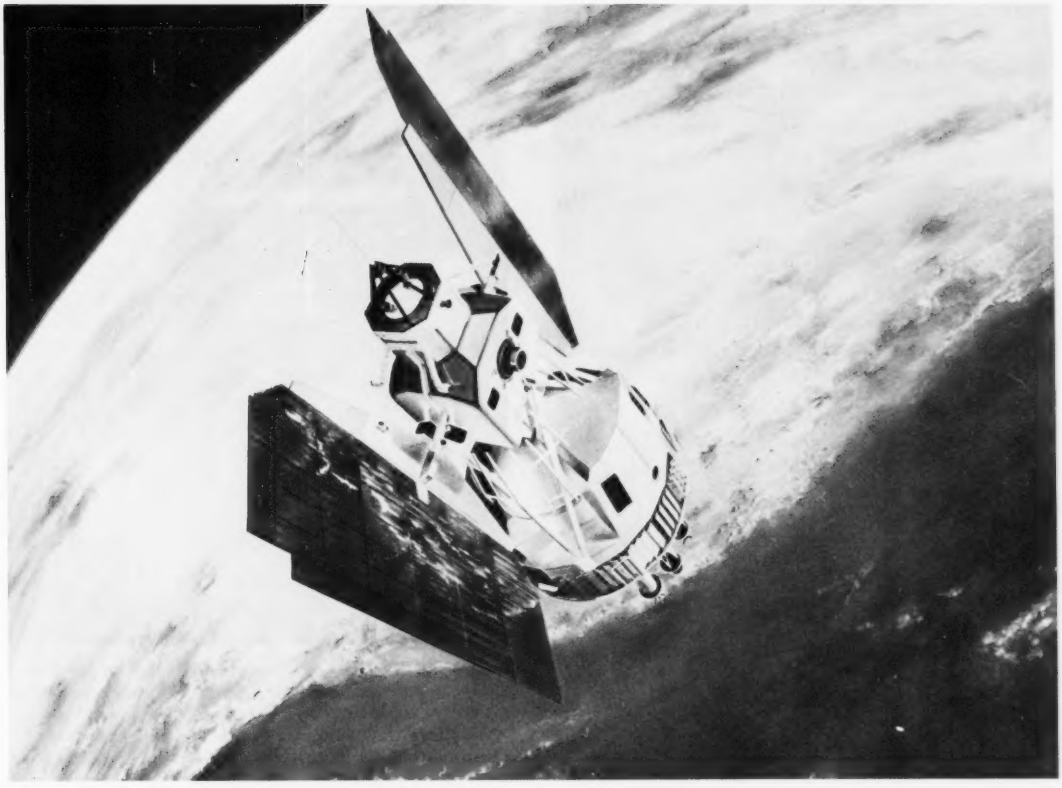
Malfunction Reduces Landsat Data

NASA's Landsat-3 spacecraft's multispectral scanner has been taken out of operational service because of a malfunction. Designed with a one-year lifetime, the spacecraft has been in orbit since March of 1978, scanning the Earth's surface to obtain resources data useful to agriculture, geology, water management and other disciplines.

The multispectral scanner senses and records light reflected from the Earth in four spectral bands, each band having its special uses. One band, for example, produces a clear delineation of land-water boundaries; another clearly shows water pollution. Three of these images are specially composited to produce a single false-color image. A growing number of users, however, completely bypass the photographic image process and extract their data from computer-compatible tapes.

Officials at NASA's Goddard Space Flight Center, home of the Landsat project, say analysis of Landsat data indicates a failure in the multiplex digitizing circuits. The multispectral scanner data have degraded below the point of general operational usefulness and all attempts to correct the problem have been unsuccessful.

Where possible, the needs of users throughout the world will be met by the multispectral scanner aboard the Landsat-2, launched Jan. 22, 1975, and still operating.



Landsat-3, its scanner now on the blink.

Meanwhile, Landsat-3's return beam vidicon camera system is still operative. As opposed to the multispectral scanner's sensors, the return beam vidicon is comprised of two panchromatic cameras which produce separate side-by-side images. Because each camera only covers an area 93 kilometers on a side, it takes four return beam vidicon scenes to cover the same area on the Earth's surface as is covered by one multispectral scanner scene.

Resolution (the smallest neighboring features that are distinguishable) for the return beam vidicon is 40 meters or twice that of the multispectral scanner resolution of 80 meters.

Return beam vidicon photos are black-and-white and cannot be composited to produce color scenes. Both return beam vidicon cameras have the same broadband spectral response (green to near infrared) of 0.505 to 0.750 micrometers.

Johns Hopkins to House Space Telescope Group

NASA has selected the Association of Universities for Research in Astronomy (AURA) of Tucson, Ariz., a consortium of 14 universities, for final negotiation of a contract to establish, operate and maintain the Science Institute for the Space Telescope, scheduled for launch in early 1985 on the Space Shuttle.

The contractor's estimated cost for the initial five-year contract is approximately $24 million, with additional funding required in support of a guest observer and archival research program as it develops. The contract will contain options for three additional five-year extensions.

The Space Telescope Science Institute will be located on the Homewood Campus of the Johns Hopkins University, Baltimore, Md. The Institute will perform critical mission science activity for the Space Telescope mission.

The 13.1-meter (43-foot) spacecraft is to be placed into a 600-kilometer (370-mile)-high orbit by the Space Shuttle and it will perform scientific investigations for at least 15 years.

The Science Institute will host American and foreign astronomers who will come to the facility to use the Space Telescope much as they would use a ground-based observatory. The Telescope's science data will be sent via the Tracking and Data Relay Satellite and the NASA communications network to the Goddard Space Flight Center, Greenbelt, Md., and then on to the Science Institute for use by the staff and guest scientists. Investigators will be able to ask controllers at Goddard to point the spacecraft at any desired field of view.

The Institute will establish Space Telescope science observation schedules, will fund United States user participation and provide direct technical support to observers before, during and after their observations. It will also support research necessary for efficient use of the Telescope, will evaluate its scientific performance and advise NASA on instrument status and will process, archive and publicize the Telescope's findings.

The Institute will staff and operate the Space Telescope Support Center at Goddard. This is essentially the section of the Operations Control Center which melds science observation requirements with practical spacecraft flight and control considerations.

Above the obscuring atmosphere, the Space Telescope's 2.4-m mirror will be able to observe 350 times the volume of space now visible from ground-based observatories. Its combination of high resolution, increased sensitivity and relatively large aperture should allow it to "see" objects 50 times fainter than can be seen from Earth. It can also study the ultraviolet region of the spectrum which is mostly absorbed by Earth's atmosphere.

NASA's Marshall Space Flight Center is Project Management Center for the Space Telescope and the Goddard Center is responsible for management of the onboard science instrumentation and Telescope operations. NASA's Office of Space Science in Washington, D.C., has overall responsibility for the program.

Other proposals were submitted by Associated Universities, Inc., Washington, D.C.; Battelle Memorial Institute, Columbus, Ohio; Universities Research Association, Inc., Washington, D.C.; and Universities Space Research Association, Columbia, Md.

Members of the AURA consortium include: University of Arizona; California Institute of Technology; University of California; University of Chicago; University of Colorado; Harvard University; University of Hawaii; Indiana University; University of Michigan; Ohio State University; Princeton University; University of Texas; University of Wisconsin; and Yale University.

Hooded Work Bench—A working model of an all-purpose table-top laboratory designed to fit into Spacelab, prime payload of the Space Shuttle, has been delivered to NASA's Ames Research Center by Lockheed Missiles and Space Company. The work station is intended to support laboratory experiments of general life sciences conducted in weightless space. The tiny lab is a controlled environment "clean room", with a camera stand available and connections that afford the experimenter electricity, water, vacuum and data links.

Life Begins at 40 for Lewis

A frame house built by woodsmen 145 years before, 200 acres of farm land, a few construction engineers and a clerk typist, and an initial allocation of $2 million for six major facilities—these were the beginnings of Lewis Research Center in Cleveland. On January 23, this lead NASA center for energy conversion technology officially celebrated its 40th birthday.

Well before the groundbreaking for the first six units on Jan. 23, 1941, Edward R. Sharp, later to become the first Lewis director, had begun assembling his team. The facility was to be called the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics. Many of the first 150 employees signed on in the old farm house near what is presently Hopkins International Airport. Growth was so rapid during World War II that, by war's end, the lab complement had risen to 2,500.

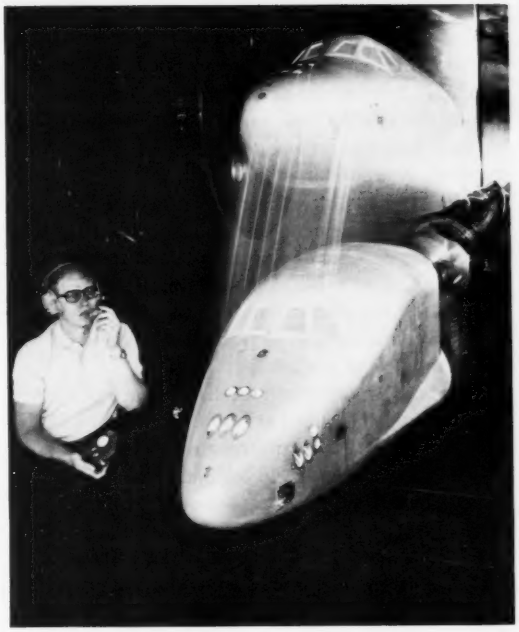
The earliest Lewis responsibility was to develop piston engine technology for aircraft that would help America emerge victorious from World War II. Later the Center would play a lead role in jet engine development and put its stamp on every plane traversing the free world today.

When the National Aeronautics and Space Administration was created late in 1958, the "Lewis Research Center" took on more than a name change. The space agency brought new programs, and dollars to develop them. For Lewis, one of the new starts would lead to the rocket fuel technology that paved the way to the moon and still powers the largest payloads sent skyward to explore the planets and serve mankind through communications and other earth application satellites.

Lewis owes its name to Dr. George William Lewis, chief executive officer of NACA from 1919 ti[illegible] 1947, a year before his death. Under his tutelage, laboratories were opened at Moffett Field, Calif., and in Cleveland to join the Langley Laboratory in Hampton, Va. Dr. Lewis was particularly adept at coordinating research programs involving several government agencies as well as prominent manufacturers.

* * *

Only an unusually talented futurist could have foreseen the changes 40 years would bring to Lewis, Dr. Walter T. Olson believes. Director of Technology Utilization and Public Affairs for Lewis, he was one



Inside Jobs at LeRC—NASA's Lewis Research Center, celebrating its 40th birthday, engages in widely varied experimentation, with the emphasis on energy. In the above picture, an engineer manipulates a Space Shuttle model in the 10 X 10 test section; in the bottom photo, an SR3 six-bladed propellor is checked out.

of the pioneering rocket propulsion experts at Lewis, having joined the center in 1942.

"Entering our 41st year, we are busy transforming windmills from quaint devices to pump water and grind grain to machines that have the potential to produce a significant amount of electric power for man's daily needs," he states.

"We're attempting to give a new lease on life to the propeller as rising fuel costs make the jet engine an expensive source of power for commercial aircraft. And we're developing plastics that are not cheap substitutes but strong, weight-saving alternatives to metal components in aircraft, automobiles and other products of modern life."

Reminiscing, Dr. Olson recalls that each of the first seven astronauts trained at Lewis. "In fact, it was the training that Neil Armstrong received on a piece of equipment designed and built at Lewis—a gimbal rig simulating weightlessness—that saved his life on one of his missions," he adds. "Significantly, much of what we developed in the course of our aeronautical and space work is being applied to directly benefit people in their everyday lives," says Dr. Olson. "Harnessing the wind and providing stronger, lightweight composites are just two examples.

"In concert with the Department of Energy, we are looking hard at ways to commercialize the electric car and provide more fuel-efficient alternative engines for passenger cars.

"We are on the threshold of demonstrating coal gasification/cogeneration technologies that could enable our country to use dirty coal in an environmentally acceptable way and with twice the energy output possible under conventional generating methods.

"Lewis engineers are striving to make more practical the use of solar cells which derive their energy from the sun and find ways to store power dependably, economically and for long periods.

"In other facets of converting and conserving energy, Lewis is also at work to offset energy losses from abroad and stretch out domestic energy supplies, all of these skills flowing from our 40 years of aerospace experience."

A far cry from the farmhouse of 40 years ago, Lewis today is a complex of 135 buildings and test facilities set on 350 acres of land. The employee complement stands at 2,800 and about a third of these are scientists and engineers. This year's budget amounts to $517 million, including a payroll of $100 million. Center officials estimate that about one fourth of that will be spent in the Greater Cleveland area for hardware, supplies, salaries and services.

Another property of Lewis, its Plumbrook Station near Sandusky, Ohio, is largely mothballed for future contingencies but increasingly is being utilized by other government organizations and industry under leasing arrangements.

* * *

"Energy conversion for the benefit of all mankind" reads the sign at the main Lewis entranceway on Brookpark Road. After all these years, the idea's still ticking.

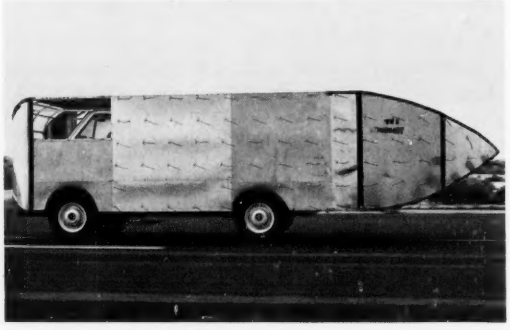
Fuel Efficient Van under Study

Fuel efficiency through the reduction of aerodynamic drag using methods developed for aircraft fuel economy is once again being investigated on a modified test van, called "The Buggy," at NASA's Dryden Flight Research Center.

The vehicle, a normal passenger van, was modified to resemble a motor home-type vehicle using aluminum and sheet metal.

Upon completion of modifications to the shape, a boattail and faired underbody (underbody is covered) was incorporated to investigate the reduction of drag and increase fuel economy. Both of these aspects were tested before but separately.

According to Randy Peterson, a graduate student assigned to NASA Dryden: "The present design has shown a gradual reduction in aerodynamic drag. The results here will be compared with those of a wind tunnel model tested at Kansas University."



Dryden's Experimental Buggy—The modified passenger van features a boattail and faired underbody. Called "The Buggy," Dryden Flight Research Center is evaluating the vehicle through the reduction of aerodynamic drag using methods developed for aircraft fuel economy.

NASA Budget Plan for Fiscal Year 1982
(Figures submitted to the Congress)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

BUDGET SUMMARY
(Thousands of Dollars)

BUDGET PLAN	FY 1980	FY 1981	FY 1982
Research and development	4,088,086	4,340,788	5,452,600
Construction of facilities	159,100	115,000	136,800
Research and program management	995,968	1,081,400[a/]	1,136,300
TOTAL BUDGET PLAN	5,243,154	5,537,188	6,725,700
OUTLAYS	4,851,637	5,286,000	6,363,400

a/ Includes proposed supplemental of $51,400,000 to cover revised salary rates implemented in October 1980.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE TRANSPORTATION

BUDGET PLAN
(Thousands of Dollars)

	FY 1980	FY 1981	FY 1982
SPACE SHUTTLE	1,871,000	1,943,000	2,230,000
Design, development, test and evaluation	(1,115,500)	(958,000)	(740,000)
Orbiter	641,900	521,000	372,000
Main engine	140,600	134,000	127,000
External tanks	79,400	54,500	25,000
Solid rocket boosters	65,200	44,500	17,000
Launch and landing	188,400	204,000	199,000
Changes/systems upgrading	(---)	(---)	(300,000)
Production	(755,500)	(985,000)	(1,190,000)
Orbiter	572,600	727,500	873,000
Main engine	123,600	121,500	105,000
Launch and landing	16,400	34,000	57,000
Spares and equipment	42,900	102,000	155,000
SPACE FLIGHT OPERATIONS	446,600	683,700	1,043,000
Space transportation system operations capability development	54,100	81,000	146,200
Spacelab	58,800	139,700	140,700
Space transportation system operations	148,100	270,700	561,300
Development, test and mission support	172,600	183,500	184,000
Advanced programs	13,000	8,800	10,800
EXPENDABLE LAUNCH VEHICLES	67,400	54,400	31,200
Scout	5,100	900	800
Centaur	18,000	5,600	---
Delta	43,100	47,900	30,400
Atlas-F	1,200	---	---
TOTAL SPACE TRANSPORTATION	2,385,000	2,681,100	3,304,200

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND DEVELOPMENT PROGRAMS

BUDGET PLAN
(Thousands of Dollars)

Cognizant Office and Program	FY 1980	FY 1981	FY 1982
SPACE TRANSPORTATION	2,385,000	2,681,100	3,304,200
Space Shuttle	1,871,000	1,943,000	2,230,000
Space flight operations	446,600	683,700	1,043,000
Expendable launch vehicles	67,400	54,400	31,200
SPACE SCIENCE	600,500	562,488	756,700
Physics and astronomy	336,800	344,700	451,400
Planetary exploration	219,900	175,600	256,100
Life sciences	43,800	42,188	49,200
SPACE AND TERRESTRIAL APPLICATIONS	343,600	365,350	487,500
Space applications	331,620	353,550	472,900
Technology utilization	11,980	11,800	14,600
AERONAUTICS AND SPACE TECHNOLOGY	426,886	390,750	469,000
Aeronautical research and technology	308,300	276,150	323,600
Space research and technology	115,586	110,700	141,000
Energy technology	3,000	3,900	4,400
SPACE TRACKING AND DATA SYSTEMS	332,100	341,100	435,200
TOTAL	4,088,086	4,340,788	5,452,600

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SCIENCE

BUDGET PLAN
(Thousands of Dollars)

	FY 1980	FY 1981	FY 1982
PHYSICS AND ASTRONOMY	336,800	344,700	451,400
High energy astronomy observatories development	2,100	---	---
Solar maximum mission development	3,100	---	---
Space telescope development	112,700	119,300	119,500
International solar polar mission development	47,900	39,600	58,000
Gamma ray observatory development	---	17,600	52,000
Orbital flight test/Spacelab 1 and 2	9,900	11,300	10,800
Shuttle/Spacelab payload development and mission management	30,700	16,100	41,000
Explorer development	32,300	33,000	36,600
Mission operations and data analysis	37,100	38,900	53,500
Research and analysis	33,774	38,000	42,500
Suborbital programs	27,226	30,900	37,500
PLANETARY EXPLORATION	219,900	175,600	256,100
Galileo development	116,100	63,100	108,000
Venus orbiting imaging radar	---	---	40,000
Mission operations and data analysis	58,800	61,800	50,900
Research and analysis	45,000	50,700	57,200
LIFE SCIENCES	43,800	42,188	49,200
Life sciences flight experiments	16,600	12,700	16,500
Research and analysis	27,200	29,488	32,700
TOTAL SPACE SCIENCE	600,500	562,488	756,700

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE AND TERRESTRIAL APPLICATIONS

BUDGET PLAN
(Thousands of Dollars)

	FY 1980	FY 1981	FY 1982
SPACE APPLICATIONS	331,620	353,550	472,900
RESOURCE OBSERVATIONS	(150,953)	(161,350)	(187,200)
Landsat-D	104,413	88,500	83,900
Magnetic field satellite	1,600	500	---
Shuttle/Spacelab payload development	2,031	2,000	2,300
Applied research and data analysis and related activities	12,405	12,800	23,200
Extended mission operations	1,904	2,700	2,800
Geodynamics	12,600	14,800	19,500
Laser network operations	---	8,600	12,400
AgRISTARS	16,000	31,450	33,100
Geological applications program	---	---	10,000
ENVIRONMENTAL OBSERVATIONS	(105,990)	(111,100)	(194,600)
Earth radiation budget experiment	13,720	20,300	24,000
Upper atmospheric research program	12,400	13,500	15,000
Extended mission operations	5,800	8,000	11,400
Applied research and data analysis and related activities	48,570	48,100	56,500
Shuttle/Spacelab payload development	9,600	1,700	5,800
Halogen occultation experiment	8,000	4,500	7,500
Operational satellite improvement program	7,400	9,200	13,800
National oceanic satellite system (NOSS)	---	5,800	34,600
NOSS research and ocean data utilization system	---	---	6,000
Upper atmospheric research satellite experiments	---	---	20,000
Completed projects	500	---	---
APPLICATIONS SYSTEMS	24,567	18,100	14,400
TECHNOLOGY TRANSFER	10,087	10,100	9,000
MATERIALS PROCESSING IN SPACE	(19,768)	(21,700)	(32,100)
Shuttle/Spacelab payload development	10,468	10,730	12,000
Applied research and data analysis	7,200	10,950	14,000
Materials experiment operations	---	---	6,100
Completed projects	2,100	---	---
COMMUNICATIONS AND INFORMATION SYSTEMS	(20,255)	(31,200)	(35,600)
Search and rescue mission	2,530	4,800	5,000
Extended operations	3,583	2,200	1,000
Applied research and data analysis	6,200	16,600	15,400
Technical consultation services	3,182	3,100	3,600
Data systems program	3,100	4,500	10,600
Completed projects	1,660	---	---
TECHNOLOGY UTILIZATION	11,980	11,800	14,600
TOTAL SPACE AND TERRESTRIAL APPLICATIONS	343,600	365,350	487,500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AERONAUTICS AND SPACE TECHNOLOGY

BUDGET PLAN
(Thousands of Dollars)

	FY 1980	FY 1981	FY 1982
AERONAUTICAL RESEARCH AND TECHNOLOGY	308,300	276,150	323,600
Research and technology base	120,767	134,300	160,800
Systems technology programs	187,533	141,850	162,800
SPACE RESEARCH AND TECHNOLOGY	115,586	110,700	141,000
Research and technology base	99,816	101,100	124,800
Systems technology programs	10,770	7,500	13,200
Standards and practices	5,000	2,100	3,000
ENERGY TECHNOLOGY	3,000	3,900	4,400
TOTAL AERONAUTICS AND SPACE TECHNOLOGY	426,886	390,750	469,000

SPACE TRACKING AND DATA SYSTEMS

TRACKING AND DATA ACQUISITION	332,100	341,100	435,200
Operations	264,400	267,100	309,800
Systems implementation	57,100	62,700	112,900
Advanced systems	10,600	11,300	12,500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1982 CONSTRUCTION OF FACILITIES PROGRAM

BUDGET PLAN
(Thousands of Dollars)

PROJECTS BY INSTALLATION

Ames Research Center	18,500
Modification of 12-Foot Pressure Wind Tunnel	18,500
Goddard Space Flight Center	2,500
Rehabilitation and Modification of Utility Systems	2,500
Jet Propulsion Laboratory	9,300
Modifications to Space Flight Operations Facility (230)	9,300
Lyndon B. Johnson Space Center	680
Rehabilitation of Utility Control System, Various Buildings	680
John F. Kennedy Space Center	2,560
Construction of Waste Material Incinerator	895
Rehabilitation and Modification of Various Buildings	840
Repair of Operations and Checkout Building Roof	825
Langley Research Center	12,710
Modifications for Enhanced 20-Inch Supersonic Wind Tunnel (1247D)	2,950
Modifications to Mach 19 Nitrogen Tunnel (1247B)	1,760
Modification of Transonic Dynamics Tunnel (648)	8,000
Lewis Research Center	12,200
Decommissioning of Plum Brook Station Reactor Facility, Phase II	1,100
Modifications for High Pressure Turbine Corrosion and Thermal Fatigue Testing	1,200
Modifications for Small Engine Component Testing (5 and 23)	9,900
George C. Marshall Space Flight Center	1,400
Modifications for Solar Electric Propulsion Systems Thruster Testing	1,400
Various Locations	6,900
Modification and Relocation of 26-Meter Antenna, STDN, Goldstone, Calif. (JPL)	4,700
Relocation of the DSS-44 Antenna to Tidbinbilla, Australia (JPL)	2,200
Space Shuttle Facilities at Various Locations as Follows:	20,050
Construction of Solid Rocket Booster Processing and Segment Storage Facilities (KSC)	12,400
Modifications to Firing Rooms (KSC)	3,100
Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)	2,785
Modifications to Building 30 for Shuttle Operations (JSC)	650
Minor Shuttle-Unique Projects (Various Locations)	1,115

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1982 CONSTRUCTION OF FACILITIES PROGRAM

BUDGET PLAN
(Thousands of Dollars)

PROJECTS BY INSTALLATION

Repair of Facilities at Various Locations, Not in Excess of $500,000 per Project	15,000
Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $500,000 per Project	20,000
Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in Excess of $250,000 per Project	4,000
Facility Planning and Design	11,000
TOTAL	136,800

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND PROGRAM MANAGEMENT

BUDGET PLAN
(Thousands of Dollars)

INSTALLATION	FY 1980	FY 1981	FY 1982
Johnson Space Center	164,664	174,254	180,411
Kennedy Space Center	133,189	152,084	162,960
Marshall Space Flight Center	155,893	165,119	171,150
National Space Technology Laboratories	4,906	5,566	5,624
Goddard Space Flight Center	133,475	143,719	151,605
Wallops Flight Center	17,685	20,366	20,414
Ames Research Center	67,374	73,849	77,921
Dryden Flight Research Center	20,408	22,587	23,767
Langley Research Center	113,982	123,000	127,620
Lewis Research Center	94,842	101,425	108,036
NASA Headquarters	89,550	99,431	106,792
TOTAL	995,968	1,081,400[a/]	1,136,300

a/ Includes proposed supplemental of $51,400,000 to cover revised salary rates implemented in October 1980.

TOTAL NUMBER OF PERMANENT POSITIONS - END OF YEAR

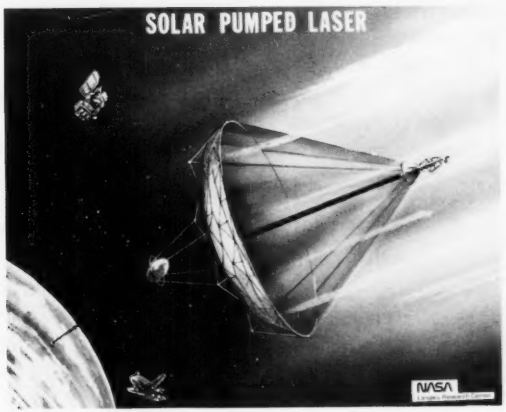
Johnson Space Center	3,469	3,489	3,489
Kennedy Space Center	2,191	2,201	2,201
Marshall Space Flight Center	3,561	3,561	3,561
National Space Technology Laboratories	103	103	103
Goddard Space Flight Center	3,444	3,444	3,444
Wallops Flight Center	395	395	395
Ames Research Center	1,658	1,658	1,658
Dryden Flight Research Center	461	461	461
Langley Research Center	2,980	2,980	2,980
Lewis Research Center	2,835	2,835	2,835
NASA Headquarters	1,516	1,586	1,586
TOTAL	22,613	22,713	22,713

Dr. Calio to Assist Dr. Lovelace

Dr. Anthony J. Calio, NASA Associate Administrator for Space and Terrestrial Applications, has been assigned to assist Dr. Alan M. Lovelace, Acting Administrator.

The announcement was made Jan. 23 by Lovelace, who stated: "NASA is now approaching one of its most important and critical periods with the first Shuttle launch only months away."

With the resignation of Dr. Robert A. Frosch, former Administrator, it is necessary to maintain adequate management capability, Lovelace said. Therefore, in this new role Calio will concern himself with NASA general management and will have decision authority, both program and functional, leaving the Acting Administrator free to concentrate on major NASA policy decisions and the Space Transportation System.



Researchers at the Langley center have made a major breakthrough in achieving first evidence of the solar pumping of a gas laser toward an eventual system. The artist's drawing is one concept of such a system, with the disk reflecting light from the Sun to a gas-filled tube, which emits a high intensity light beam.

Sampling Station—The Johnson Space Center's Aircraft Operations Division recently completed its 20th mission of the WB-57 aircraft in support of the Department of Energy's Project Airstream. The plane, NASA 928, is the only four-engine jet flown by one pilot. It has conducted high altitude sampling operations over the Southern United States, Panama, Peru and Uruguay.

In Three Dimensions—Dr. Rick Chappell, left, chief of the Solar Terrestrial Physics Division at the Marshall Space Flight Center discusses the first three-dimensional model of the Earth's magnetosphere with Shelby Morris and Dr. James Green of the division. The display shows the normally invisible nature of the solar terrestrial environment and is the first of its kind to show the motion of ionized gasses that come from the Sun. The model will be displayed at the Alabama Space and Rocket Center in Huntsville.

New Ozone Testing Device

A new instrument mounted on an aircraft has measured ozone concentration and distribution in a column of atmosphere for the first time. The instrument is called Ultra Violet Differential Absorption LIDAR and was developed by NASA for the Environmental Protection Agency. Previous instruments could give such data on ozone only in the area immediately surrounding the aircraft.

LIDAR, light intensification detection and ranging, is similar to radar but uses electromagnetic waves of much shorter wavelength. Ozone is a component of photochemical smog which can be hazardous to health.

The new instrument uses light of two different wavelengths. One of the wavelengths is absorbed by ozone and the other is not. The difference between the two combined signals is analyzed to determine concentration and distribution of ozone in a column beneath the aircraft.

Conventional LIDAR has been used for years to detect particulate matter in the atmosphere. In these systems, an extremely short pulse of light is fired from the airplane toward the ground. It travels downward through the air at the speed of light and is then scattered back to the system in proportion to the amount of fine particulates in the atmosphere.

Future plans include increasing daylight sensitivity by using a more powerful laser and developing a similar instrument to measure sulfur dioxide. The range is now limited during certain daylight hours because solar radiation also scatters light off atmosphere particulates.

Taylor Resigns as NASA I. G.

Eldon D. Taylor's resignation as Inspector General of NASA was accepted in January by The White House. J. Brian Hyland, Assistant Inspector General for Investigations, will serve as Acting Inspector General until the post is filled by President Reagan.

Taylor was appointed as NASA Inspector General July 30, 1979, the first person to fill the position created by the Inspector General Act of 1978.

In accepting Taylor's resignation, President Carter said:

"I deeply appreciate the integrity and skill with which you have carried out your responsibilities as the Agency's first Inspector General. You have done a superb job of establishing this important office. Your efforts at hiring outstanding auditors to serve in the nationwide program have truly earned you the respect of your colleagues."

Awards Column

Two engineers at NASA's Jet Propulsion Laboratory were honored in December for their contribution to the precise navigation of spacecraft and to the confirmation of the validity of predictions of Einstein's Theory of Relativity.

Warren L. Martin and Dr. Richard M. Goldstein each received a NASA Certificate of Recognition and a $5,000 cash award, presented by Dr. Frosch.

As for honors granted NASA employees in the decade just past, Mrs. Dema Nappier, retiring Executive Secretary of the Incentive Awards Board, compiled the following list:

—Twenty-five NASA people given Presidential Rank awards in 1980, both in the Distinguished Executive and Meritorious Executive categories.

—More than 55 Presidential Recognition Letters prepared with White House approval.

—Three Flemming winners in two separate years. Johnson Space Center and Ames one year and Langley Research Center in 1979.

—Two Presidents' Distinguished Federal Career Service Award winners.

—Two National Civil Service League Award winners.

—Winners for the Astronautics Engineer Award—Charlie Hall, Ames, 1978; Max Faget, Johnson Space Center, in 1979.

—A winner for the Young Engineer's Award in 1977—Goddard Space Flight Center.

—At a White House ceremony, two Marshall employees for the Presidential Management Improvement Award in 1977. President Carter made the presentation to Curtis Helms and Thomas Winstead with Drs. Frosch, Lovelace and Lucas in attendance.

—The first recipient of the Roger W. Jones Award for Executive Leadership was Ed Kilgore, presented in 1978. Dr. Kraft received the award in 1979.

—The largest special Awards Ceremony in the history of the Agency was the Viking Ceremonies in 1977—one at the Jet Propulsion Laboratory and the Langley Research Center and the first at a contractor's plant—Martin Marietta. 377 awards presented.

—NASA's 20th Anniversary and the presentation of the Congressional Space Medals of Honor by President Carter to six astronauts (one post-humously).

—Five Executive Performance Awards—four for $5,000 and one for $10,000, before implementation of the Civil Service Reform Act in 1978.

—Special HEAO-1 ceremony at Marshall Space Flight Center in 1979.

—Special Approach and Landing Test ceremony at Johnson Space Center in 1978 with twenty persons awarded.

—Winner for two years for the Federal Paperwork Management Award—Headquarters and Johnson Space Center.

—For two years NASA received the Certificate of Recognition on the Horace Hart Award.

—In 1979 NASA employee Kathleen Charles, Code E, received the William T. Jump Award.

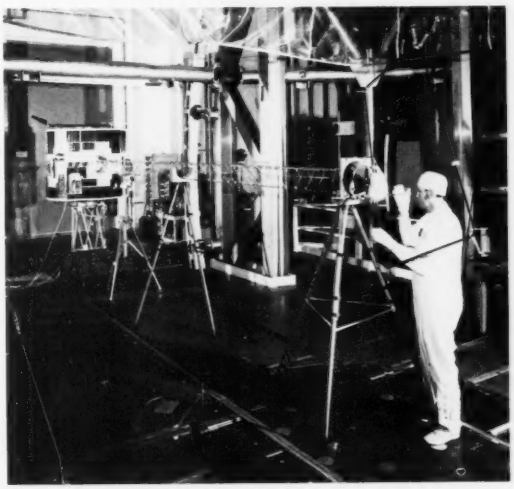
—Winners of the Goddard Memorial Trophy: 1977—Viking Project Team, 1979, Dr. Chris Kraft; and 1980 NASA/Jet Propulsion Laboratory Voyager Project Team.

—Certificate of Recognition was awarded to Dryden Flight Research Center for the Energy Efficiency Award in 1980.

—Wright Bros. Memorial Trophy's candidate, Dr. Olive Beech, was the winner in 1980.

Ed. Note:

In both political and government parlance, the record speaks for itself.



Testing the DE-A—The Dynamics Explorer-A (DE-A) is shown undergoing preflight evaluation in the Magnetic Test Facility at the Goddard Space Flight Center. With its sister spacecraft, DE-B, it will be stacked in tandem atop a conventional Delta launch vehicle and placed into polar orbit from the Western Test Range on July 31, 1981. The two spacecraft will explore the boundary region between Earth and space affecting weather climate, atmosphere, auroral displays and radio transmissions.

Evaluating the Albatross—NASA has completed its flight testing of the pedal-powered Gossamer Albatross and has begun analysis of the results. The lightweight contraption was flown 27 times as part of the Langley/Dryden flight research program. Results may lead to application to future high altitude aircraft.

HEAO-2 Resumes Operation

The orbiting Einstein observatory has returned to full time scientific operation after an onboard gyro, which failed last August, inexplicably came back to life, according to controllers at the Goddard Space Flight Center.

First indications of maneuvering problems in the X-ray observing satellite were noted last summer, limiting the observatory's scientific investigations. Goddard ground controllers modified radio command instructions to the spacecraft—allowing them to by-pass the troubled gyro and to continue operations with the two remaining gyros. Since mid-October, controllers had attempted repeatedly to reactivate the faulty gyro by sending literally thousands of radio commands to the ailing subsystem with no effect.

For reasons not fully known, the inactive gyro began to function normally in December and the spacecraft was able to resume normal operations.

The satellite, known officially as the High Energy Astronomy Observatory (HEAO-2), was launched Nov. 13, 1978. It was nicknamed Einstein by the scientists involved in the mission because of the proximity of its launch date to the 100th anniversary of Albert Einstein's birth.

Designed for an operational life of one year, the observatory has operated for more than two years and is expected to continue for several months before its propellant supply is exhausted.

"Wind Farm" Producing Power

The nation's first "wind farm," featuring three of the largest government-built advanced wind turbine systems, is nearing completion. The turbines are the seventh, eighth and ninth wind turbines to be built under the portion of the Federal wind energy program managed by Lewis Research Center, Cleveland, for the Department of Energy.

The first of the three new machines began producing electricity for the Bonneville Power Administration at Goodnoe Hills near Goldendale, Wash., late last year. The second machine was fully assembled and began to generate electricity in February. The third machine is expected to be fully assembled and running late this spring.

The three machines, each rated at 2,500 kilowatts, will be the first clustering of these experimental wind turbine systems. They have been designed to bring the cost of wind-generated electricity very close to the cost of power generated through the burning of fossil fuels.

When all three are operating—by mid-1981—they will feed 7,500 kw of electricity into the Bonneville power grid, enough to supply 2,000 to 3,000 average homes.

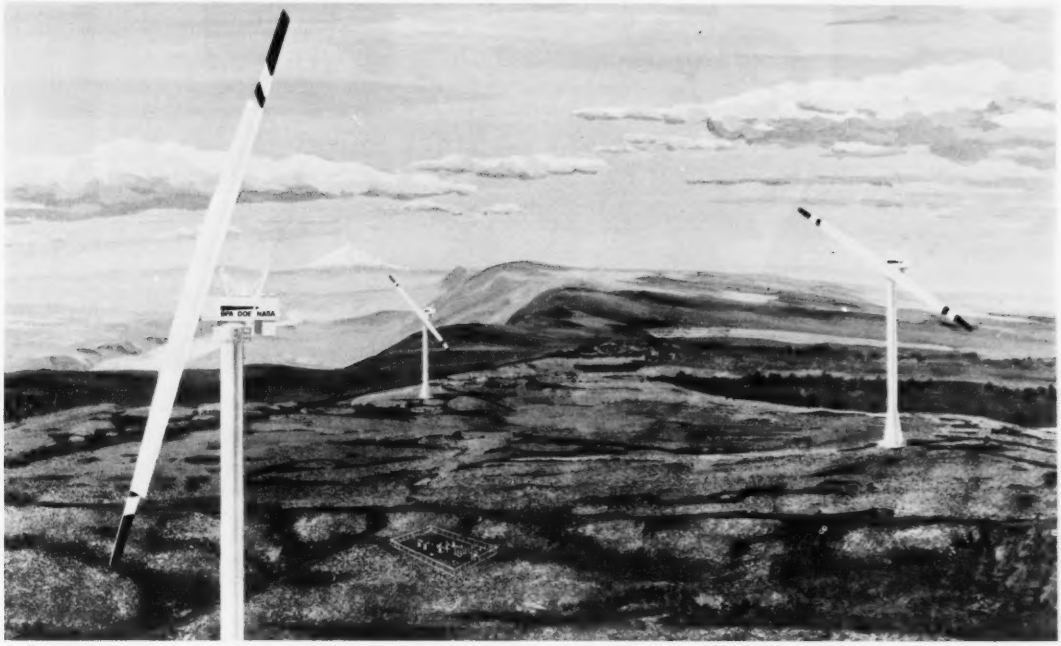
Designated Mod-2, the machines are the largest and most powerful wind turbines ever built. The three Goldendale wind turbines, designed to have a system life of 30 years, were built by the Boeing Engineering and Construction Co. of Seattle under contract to NASA-Lewis. Under earlier Department of Energy funded projects, started in 1974, NASA-Lewis built six smaller developmental units ranging in power output from 100 to 2,000 kilowatts.

In terms of design, size, appearance and performance, the new machines encompass significant modifications and advancements over the earlier models.

According to NASA-Lewis project manager Jim Couch, "Experience gained in the operation of the earlier turbines has enabled us to simplify mechanical operations, reduce system weight, lower manufacturing costs and improve performance.

These first three Mod-2 prototype wind turbines cost $13 million to build and install. It is estimated by Lewis engineers that they will produce electricity at a cost of less than 8 cents per kw hour.

If these same machines were to be produced in



Artist's view of the nation's first "wind farm", managed by the Lewis center.

quantities of 100 per year or more, the 100th wind turbine would provide power at a cost of less than 5 cents per kwh.

The Goodnoe Hills Complex is set up in a triangular pattern, ranging from 460 to 915 meters apart, to form a small turbine "farm." NASA engineers predict that farms of 25, 50 or 100 wind turbines may be producing truly significant amounts of cost-effective electricity by the end of the century.

The new Mod-2 wind turbines are 61 meters high and produce power from the rotation of their steel rotor blades which measure 91 meters from tip to tip.

Each machine's rated power output of 2,500 kw is achieved at a blade speed of 17.5 revolutions per minute in a rated wind speed at the top of the tower of 44 kilometers per hour. (Rated wind speed is defined as the lowest wind speed at which full power can be achieved.) The power output in relation to the wind speed is regulated by varying the pitch of the 13.7-m-long, articulated blade tips.

It takes 22.5 km/hr of wind to start the blades rotating; and at a wind speed of 72 km/hr, the machine is designed to shut itself off to preclude excess stress on the blades and possible damage. However, the machine, in a stationary mode, can withstand winds up to 200 km/hr.

A drive train, including an improved, three-stage, planetary gear box converts the 17.5 revolutions of the blade into 1,800 rpm's of the generator. Among the major design innovations and cost savings modifications that have been incorporated into the Mod-2 wind turbines are:

- *Blade Tip Control:* Unlike their predecessors, which were feathered along their full length, the speed of the Mod-2's blades is controlled by varying the pitch of only the 13.7-m-long blade tips. This has enabled designers to reduce rotor weight and cost.
- *Tower:* Towers for all prior machines were of rigid truss design. These have been replaced by the more flexible, more aesthetic, simpler tubular design, a modification that has permitted the use of less expensive, factory-assembled components and an overall reduction in the amount of materials required for tower construction.
- *Rotor Blades:* The welded steel blades are fastened to the hub in a straight line fashion and are positioned upwind of the tower.

Through the use of a teetering mechanism at the hub, the blade assembly is able to tilt as much as 6 degrees in response to wind loads. This design feature reduces loads on all of the turbine components and has resulted in lower costs.

Concluding Agreement—Dr. Robert A. Frosch and Dr. Ali A-Mashat, Director General of the Arab Satellite Communications Organization signed a memorandum of understanding in January, providing for launch by NASA of two geosynchronous orbiting communications satellites in 1983-84. The satellites will furnish space-borne communications for the 23-nation Arab League.

Parting Honor—As outgoing NASA Administrator, Dr. Frosch was given an award of appreciation by the Headquarters Employees Equal Opportunity Advisory Group. On Frosch's right is Lewis E. Andrews, co-chairperson of the group. Mary Anne Stoutsenberger is the other co-chairperson. The honor was paid Frosch for his "outstanding contribution to the concept of equal opportunity . . . and his continuing effort and cooperation toward that goal."

Patents for Inventions from NASA Research

The office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title	Patent No.	Installation
Lester S. Hieda, Caltech/JPL	Controller for computer control of brushless DC motors	4,249,116	NRO/JPL
Henry A. Spang, III, Robert P. Wanger, General Electric Co., Cincinnati	Apparatus for sensor failure detection and correction in gas turbine engine control system	4,249,238	LeRC
Lewis L. Lacy, Michael B. Robinson, Daniel B. Nisen, NASA/MSFC	Containerless high temperature calorimeter apparatus	4,248,083	MSFC
Jireh I-Le Chao, Charles H. Epps, Jr., Howard Univ., Washington, D.C.	Locking mechanisms for orthopedic braces	4,252,111	GSFC
Robert F. Fedors, Mohammad N. Sarbolouki, Caltech/JPL	Photomechanical transducer	4,252,440	NRO/JPL
Cyril Feldstein, Gilbert W. Lewis, Virgil H. Culler, Samuel Meerbaum, Caltech/JPL	Multifunctional transducer	4,249,417	NRO/JPL
Krishna M. Koliwad, Taher Duad, Caltech/JPL	Copper doped polycrystalline silicon solar cell	4,249,957	NRO/JPL
Coleman J. Bryan, Edward E. Wright, Jr., Clyde V. Moyers, NASA/KSC	System for sterilizing objects	4,250,143	KSC
James J. Kerley, NASA/GSFC	Portable appliance security apparatus	4,252,007	GSFC

Meeting the P.M.—On a recent visit to the Australian tracking stations, astronauts David Walker and Sally Ride present a model of the Space Shuttle configuration to Australian Prime Minister Malcolm Fraser. Walker is a Lieutenant Commander, U.S. Navy, and Ms. Ride is a civilian wih a Ph.D. in physics.

Contractor News

Martin Marietta Aerospace, Denver Division, has reached agreement with the Marshall Space Flight Center to amend a contract to add and modify tooling to support the production rate of 24 Space Shuttle lightweight external tanks a year. The amendment adds $66.5 million to the existing external tank design and development contract, bringing the total value to more than half a billion dollars. The contract now calls for the new and modified tooling to be in place at the production facility by December 1982.

Frank Briscoe Company, Inc., of Roseland, New Jersey, has been awarded a contract totalling almost $4 million for activation and modification of the Orbiter Processing Facility's High Bay 2. Under the fixed price contract given by the Kennedy Space Center, the company will install ground support equipment for the Space Shuttle orbiter's hydraulic system and will construct platforms for installation of the thermal protection system and for access to payload bay doors. Activating the High Bay for the acceptance of an orbiter will take about 14 months.

Solarex Corp. of Rockville, Md., and Westinghouse Advanced Energy Systems Div. of Pittsburgh have won awards by the Jet Propulsion Laboratory to demonstrate low-cost mass production of solar cell

modules. Solarex was given a contract valued at $2.28 million while Westinghouse Advanced will earn $3.4 million. The work will focus on Module Experimental Process System Development units, which will incorporate solar cell technology advances made during the past five years. Each company will pursue a different approach, leading to a technical readiness demonstration by the end of 1982.

Fluid Scientific, Inc., of Orlando, has been selected by the Kennedy Space Center to provide for the fabrication of 58 pneumatic panels to be used for launch support of Space Shuttle vehicles at Vandenberg Air Force Base in California. Shuttles destined for Polar orbit will be launched from Vandenberg. The fixed price contract is set at $3,213,996.

Boeing Aerospace Company of Seattle has been granted a two-year extension on its million and a half dollar contract for Inertial Upper Stages/ Spacecraft Interface Verifications operations. The agreement with Johnson Space Center covers activities and services required to support the mating and verification of Inertial Upper Stages and their associated spacecraft.

Did You Know?

Jupiter and Saturn are staging a space spectacular this year. Their orbits are aligned so that they appear to dance around each other. It happens only once every several hundred years. Three times in 1981, the two planets will give the illusion of actually switching places. According to Dr. Thornton Page, NASA visiting astronomer at the Johnson Space Center, the event is called a retrograde loop and the next time it will happen will be July 30. Some historians believe that a similar planetary conjunction explains the biblical "Star of Bethehem."

The Aerospace Contribution to Society Award this year went to Louis Mogavero, former Director, Technology Utilization, Office of Space and Terrestrial Applications, NASA, and now President of TRANTEC, Inc. The award from the American Institute of Aeronautics and Astronautics recognizes a notable contribution to society through application of aerospace technology to societal need, specifically Mogavero's efforts to aid the handicapped.

The world's first sunlight powered gas laser has been demonstrated by researchers at Langley Research Center. Light output from a solar simulator was directed onto a quartz tube filled with gaseous iodide. Researchers J.H. Lee and Willard Weaver say the directly Sun-powered laser would eliminate the need in current systems of intermediate energy conversion to achieve lasing.

NASA's first 50-year service medal has been awarded to a research engineer at the Lewis Research Center. Isidore Warshawsky is the first space agency employee to reach the 50-year mark in government service. Warshawsky began his government career with NACA, the National Advisory Committee on Aeronautics, back in 1930.

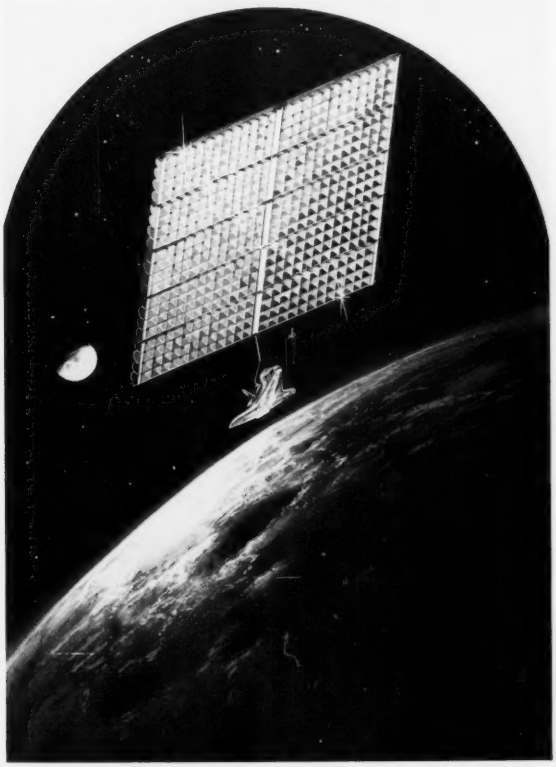
Idea Clearinghouse cites the well established Equipment Visibility System (EVS) for its capacity to make available equipment items for minimal cost wth a "guarantee" of satisfaction. A recent example at NASA's Wallops Flight Center highlights the timely and cost effective use of EVS to satisfy program instrumentation requirements.

It was highly desirable that a system be operational in time to support severe storm hazard tests at Wallops during the spring and summer of 1981. Needed were radar monitors and video tape recorders to enable Wallops staff to accept video recordings which make real-time radar data available after the fact for severe storm experimenters. The EVS identified inactive equipment valued at more than $150,000 to satisfy this requirement which was acquired for no more than freight cost.

The "guarantee" results from the requiring office directly contacting the previous user to get assurances of applicability, quality and condition. Since the program began, over 17,000 items have been distributed each with an average acquisition value of over $20,000. If you are wondering how you can acquire some of the more than 24,000 items currently available, contact your installation EVS coordinator or at Headquarters, Danalee Green, Code BEM on 755-8310.

Launches for 1981

Name	Launch Date	Vehicle	Range	Mission Remarks
COMSTAR-D	February 21	Atlas Centaur	ESMC	Comsat General Corp. communications. Reimbursable.
Intelsat V-B	March	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
GOES-E	March	Delta	ESMC	NOAA weather. Reimbursable.
Navy 20 (NOVA 1)	April	Scout	WSMC	DOD transit. Reimbursable.
SBS-B	April	Delta	ESMC	SBS communications. Reimbursable.
NOAA-C	May	Atlas-F	WSMC	NOAA weather. Reimbursable.
Intelsat V-C	June	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
RCA-D	June	Delta	ESMC	RCA communications. Reimbursable.
FLTSATCOM-E	June	Atlas Centaur	ESMC	DOD communications. Reimbursable.
Dynamic Explorer	July	Delta	ESMC	NASA scientific.
Navy 21 (NOVA 2)	September	Scout	WSMC	DOD transit. Reimbursable.
Intelsat V-D	September	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
Solar Mesospheric Explorer	September	Delta	WSMC	NASA scientific.
RCA-C1	October	Delta	ESMC	RCA communications. Reimbursable.
NOAA-D	November	Atlas-F	WSMC	NOAA weather. Reimbursable.
Intelsat V-E	December	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.



Solar Power System—An artist has conceived of the huge multikilowatt system that may someday generate up to 1000 kilowatts of solar electricity in space. The system is one of several being considered by NASA to provide additional power for Space Shuttle operations and a study is being conducted by the Lockheed Missiles and Space Company of Sunnyvale, Calif. Another concept is a solar array wing that would fly aboard the Shuttle in the early 1980s.

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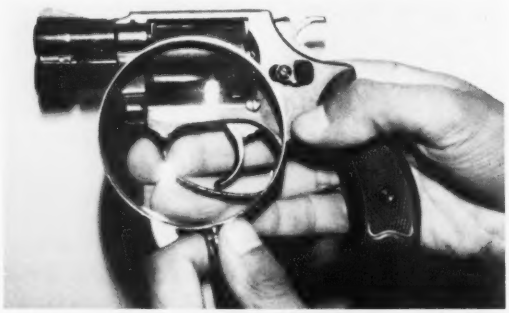
Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Restoration Process

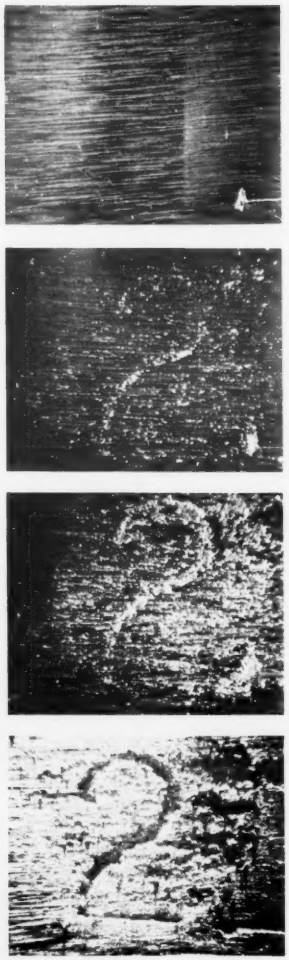
The revolver has had its serial numbers obliterated but in the four-photo sequence, a digit is brought back to clear readability. The restoration is due to a process developed by NASA's Lewis Research Center in conjunction with Chicago State University.

Serial numbers and other markings are frequently eliminated from guns, cars and trucks, cameras, appliances and jewelry to prevent the tracing of ownership. Crime laboratory investigators often employ a chemical etching technique to bring the numbers back. This



requires extensive grinding and polishing in preparation and may cause metal erosion.

The new Lewis Research Center Chicago State process can be applied without variation to any kind of metal and needs no preparatory work. The system is called "cavitation" and occurs when a liquid is subjected to rapid vibration. The metal object is immersed in water and ultrasonic energy is applied while a probe vibrates. This produces vapor bubbles which impact the metal surface and pit it. Pitting around the area where the serial number was stamped gradually restores the image. The technique has won the endorsement of a number of civil and military law enforcement agencies.



For the benefit of all . . .

NASA
National Aeronautics and Space Administration